TRAFFIC SPEED REPORT
NO. 68
TRUCK WEIGHT-SPEED STUDY

NOVEMBER 1959
NO. 27

Joint Highway Research Project

PURDUE UNIVERSITY
LAFAYETTE INDIANA

by

D.F. PETTY

TRAFFIC SPEED REPORT NO. 68
TRUCK WEIGHT-SPEED STUDY

TO: K. B. Woods, Director
Joint Highway Research Project

November 13, 1959

FROM: H. L. Michael, Assistant Director
Joint Highway Research Project

File: 3-3-4
Project: C-36-10D

Attached is Traffic Speed Report No. 68. This is a report of the 1959 Truck Weight-Speed Study. The Project has cooperated with the Highway Planning Survey Unit of the State Highway Department for a number of years in the conduct of this study. Project personnel obtain the speeds while State Highway Department personnel obtain the weights of trucks at selected stations during the month of August.

The Speed Study in 1959 was performed by Mr. Donald F. Petty, Research Assistant on our staff assisted by Mr. Vergil Stover, Graduate Assistant on our staff. Results of this year's study indicate a continuing increase in the speed of heavy trucks and in their weight. A significant decrease in the number of trucks exceeding the legal speed limit was also noted primarily because of an increase in the legal speed limit for trucks on the highways in Indiana.

This report, as usual, will be distributed to the State Highway Department, Bureau of Public Roads, and the State Police. Report is submitted for the record and for release.

Respectfully submitted,

H. L. Michael

H. L. Michael, Secretary

HLM:pg

Attachment

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Progress Report

Traffic Speed Report No. 68
Truck Weight-Speed Study

by

Donald F. Petty
Research Assistant

Joint Highway Research Project
Project: C-36-10D
File: 8-3-4

Performed in Cooperation
with
The State Highway Planning Survey
State Highway Department of Indiana

August 6, 12, 13, 14, 19, 24, 25, 26, 28, 1959

Purdue University
Lafayette, Indiana

November 19, 1959

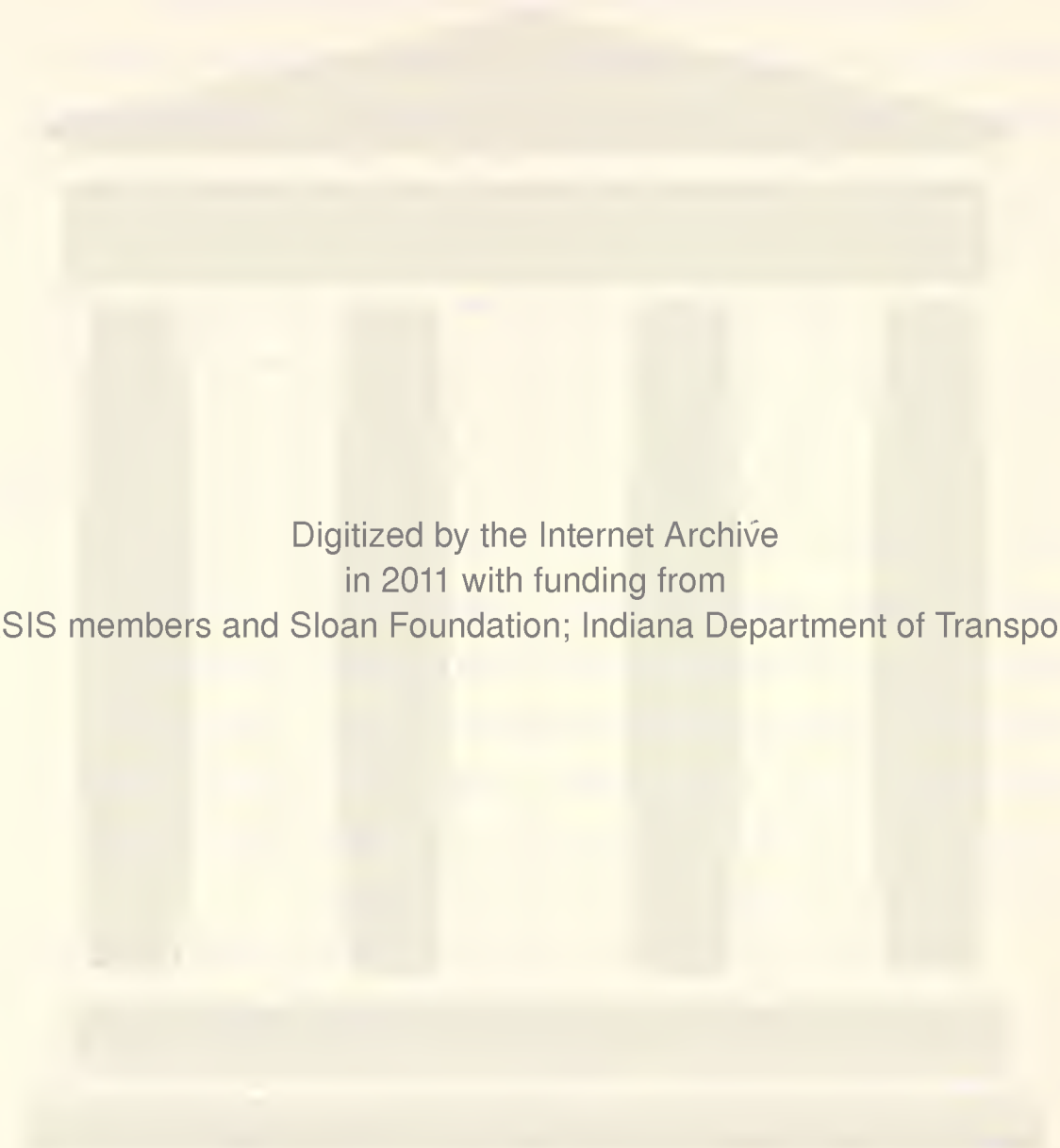
TRAFFIC SPEED REPORT NO. 68
TRUCK WEIGHT-SPEED STUDY

INTRODUCTION

The Joint Highway Research Project of Purdue University cooperated with the Highway Planning Survey Unit of the State Highway Department of Indiana, in conducting the annual truck weight-speed study during August 1959. This was the fifteenth year that this study has been performed.

Prior to 1944, studies were limited to a determination of truck weight distribution patterns and twenty permanent truck-weight stations were selected for this purpose. The first of the annual truck weight-speed studies was made in 1944 and they have been continued to the present with the exception of 1945. When the truck weight-speed studies were initiated in 1944, speeds were taken at only four of the twenty truck weight stations. The number of truck speed stations increased from 1944 until 1951 when twelve speed stations were used. This number remained constant from 1951 to 1953. In 1954, 1955, and 1957, speeds were taken at ten of these twelve stations. In 1956, 1958, and this year, speeds were observed at nine of these stations.

The speed observations for this study were made with a Streeter-Amet pnumatic tube speed meter. The tubes were each anchored across the highway eleven feet apart. Vehicular speed with this equipment is measured by a timer, which is activated when the front wheels of a vehicle cross the first tube, and turned "off" when the front wheels cross the second tube. The meter is calibrated in miles per hour instead of time, because a distance of eleven feet between the tubes is



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always used. The observers concealed themselves and the meter box as much as local conditions permitted. However, the tubes across the highway could not be concealed, and they were observed by a sizeable number of the truck drivers. A definite slowing or braking by some drivers was observed and the speeds of these vehicles were not recorded. This effect was not the same for all stations because of color of the highway, shade conditions and local enforcement policies.

The meters and car speedometer were calibrated before any data were taken. The calibration was then checked at least once during each day of operations and any necessary corrections were recorded.

The speed data were collected by the writer and Mr. Vergil G. Stover, and analyzed by the writer and members of the Traffic Engineering Laboratory staff.

OBSERVATION PROCEDURE

The weight stations used for the coordinated truck weight-speed study, which are shown on the attached map of Indiana (Figure 1), were located as indicated below, and were operated on the dates shown:

Date	Station	Highway	Location	No. Of Lanes
Aug. 6	45B	S.R. 67	1.00 miles S. W. of Muncie	2
Aug. 12	5	U.S. 30	1.30 miles E. of E. city limits of Bourbon	2
Aug. 13	4	U.S. 31	1000' S. of Jct. of U.S. 6	4
Aug. 14	2	U.S. 20	1500' W. of Jct. of S.R. 2	4
Aug. 19	14	U.S. 41	0.50 miles S. of N. Jct. of S.R. 2	4

Aug. 24	42	U.S. 52	600' S.E. of N. Jct. of S.R. 28	4
Aug. 25	58B	U.S. 31	1000' S. of Jct. of Co. Rd. to Southport	4
Aug. 26	75	U.S. 41	0.25 miles S. of Jct. of U.S. 41, business route	4
Aug. 28	81	U.S. 150	0.50 miles E. of W. Jct. of S.R. 56	2

The speed stations were selected on the basis of topography and alignment and were usually located from one to three miles from the weight station. There was only one exception to this. At Station two, construction work forced the speed station to be moved approximately 6 miles from the weight station. However, sufficient data were collected for use in this report. In all cases the distance between the weight station and the speed station was sufficient to allow trucks which had been stopped to regain their normal cruising speed.

The weighing crew, operating portable loadometer scales, stopped and weighed all trucks moving in a given direction for a four hour period. During the subsequent four hours, trucks moving in the opposite direction were stopped and weighed. This eight hour period was from 8:00 A.M. to 4:00 P.M. C.D.T. at each station.

The speed stations were operated during the same time period as the weight stations. At each speed station, the speed of each truck moving in the proper direction was recorded to the nearest mile per hour.

To aid in the correlation of the speed and weight data, the weight crew and speed crew briefly described each truck. The color, owner, and type of truck were listed as well as the time at which the truck passed each station. Speed and weight information, however, could not be

obtained for every truck that passed each station. Many trucks turned off between the speed station and the weight station. Also, because "free moving" truck speeds were desired for this study, some speeds were not taken because certain trucks were obviously restrained by other traffic.

REPORTING PROCEDURE

For the purposes of this report, all trucks were divided into two groups. These groups are single-unit trucks and multiple-unit, semi-trailers. The former group was further subdivided for some of the analysis into those having a gross weight of 5,000 pounds or more and those having a gross weight of less than 5,000 pounds in order to compare the observed speeds of these units with the existing speed limits. The present legal speed limits are 50 and 55 miles per hour for trucks with a weight of 5,000 pounds or more and 65 miles per hour for trucks with a gross weight of less than 5,000 pounds.

Table I provides the speed and weight data observed at each station for single-unit trucks weighing less than 5,000 pounds. Similar information is presented in Table I for all single-unit trucks with gross weight greater than 5,000 pounds. Table II is arranged in a manner similar to Table I in order to provide all speed and weight data for semi-trailer multiple units. The number and percentage of vehicles exceeding the legal and "enforcement" speed limits, by station, is presented in Table III. All-station curves for single-unit trucks and for semi-trailers are shown in Figure 2. Similar speed accumulation curves for single-unit trucks and semi-trailers on two-lane and four-lane

highways are shown in Figures 3 and 4 respectively. A speed-weight comparison is presented in graphical form for single-unit trucks in Figure 5 and for semi-trucks in Figure 6.

The fastest vehicle observed was a panel truck, traveling at 80 miles per hour. The weight for this vehicle, however, was not recorded.

The heaviest vehicle observed was a 3-axle tractor with a 2-axle flat-bed trailer having a gross weight of 101,800 pounds and traveling at 30 miles per hour.

SUMMARY OF RESULTS

From Tables I and II the following observations are made:

Single-Unit Trucks with a gross weight of less than 5,000 pounds:

Number of vehicles observed	133
Average speed	47.2 MPH
Average weight	4380 pounds
Per cent empty	31.6

Single-Unit Trucks with a gross weight of over 5,000 pounds:

Number of vehicles observed	348
Average speed	44.9 MPH
Average weight	11,100 pounds
Per cent empty	30.8

All Single-Unit Trucks

Number of vehicles observed	481
Average speed	45.5 MPH
Average weight	9230 pounds
Per cent empty	31.0

Semi-Trailers (Multiple-Units)

Number of vehicles observed	604
Average speed	48.6 MPH
Average weight	40,300 pounds
Per cent empty.	32.8

Data for 1948 through 1958 have been obtained and are compared with the 1959 data in Table IV.

The data obtained during the 1959 study indicate that for single-unit trucks weighing less than 5,000 pounds, the average speed decreased

1.4 miles per hour and the average weight increased 280 pounds, since 1958.

For single-unit trucks weighing more than 5,000 pounds, the average speed decreased 1.0 miles per hour and the average weight decreased 300 pounds from the previous report in 1958.

Multiple-unit trucks (semi-trailers) increased their average speed 2.5 miles per hour and increased their average weight 800 pounds from 1958.

It was observed that 2.3 per cent of the trucks weighing under 5,000 pounds were exceeding the legal speed limit of 65 miles per hour and that none were exceeding 70 miles per hour. For single-unit trucks weighing over 5,000 pounds, 20.7 per cent were exceeding the legal speed limit of 50 miles per hour on two lane roads and 55 miles per hour on four lane roads where there was a median strip of twenty feet or more. In this single unit class, only 6.9 per cent were traveling more than 5 miles per hour over the legal speed limit. For multiple-unit trucks, 21.7 per cent were exceeding the legal speed limit of 50 miles per hour on two lane roads and 55 miles per hour on four lane roads. Only 5.8 per cent of these trucks were traveling more than 5 miles per hour above the legal speed limit.

The results indicate a decrease in speed limit violations for all classes of vehicles since 1958.

The percent violations are shown below for each group for 1958 and 1959:

	Per cent Exceeding Legal Speed		Per cent Exceeding Legal Speed by 5 MPH	
	1958	1959	1958	1959
Single-unit trucks less than 5,000 pounds	2.9	2.3	0.6	0.0

Single-unit trucks more than 5,000 pounds	49.4	20.7	22.3	6.9
Multi-unit trucks	55.0	21.7	16.0	5.8

The speed limit for trucks weighing over 5,000 pounds, however, was raised 5 miles per hour (45 - 50) except that on four lane roads that have a median strip at least 20 feet wide the speed limit was raised 10 miles per hour (45 - 55).

TABLE III
VEHICLES EXCEEDING SPEED LIMIT

	TRUCKS WEIGHING UNDER 5000 LBS.			TRUCKS WEIGHING OVER 5000 LBS.			MULTIPLE UNITS		
Station	No. Noted	% Exceeding 65 MPH*	% Exceeding 70 MPH**	No. Noted	% Exceeding 50 MPH*	% Exceeding 55 MPH**	No. Noted	% Exceeding 50 MPH*	% Exceeding 55 MPH**
45-B	12	8.3	0.0	42	35.0	17.5	64	37.5	17.2
4	13	0.0	0.0	45	31.9	10.6	72	23.6	4.2
5	7	0.0	0.0	31	40.0	20.0	85	31.8	8.2
81	9	0.0	0.0	23	8.0	0.0	12	50.0	16.7
					% Exceeding 55 MPH*	% Exceeding 60 MPH**		% Exceeding 55 MPH*	% Exceeding 60 MPH**
2	3	0.0	0.0	17	17.6	0.0	59	19.3	3.5
14	15	6.7	0.0	36	25.0	13.1	103	20.5	4.1
42	6	0.0	0.0	13	27.9	4.7	78	24.4	6.4
56-B	23	0.0	0.0	54	1.9	0.0	42	1.4	0.0
75	40	2.5	0.0	56	7.1	0.0	42	2.4	0.0
Summary	129	2.3	0.0	348	20.7	6.9	604	21.7	5.8

* Legal Speed Limit for the Various Classes of Highways and Vehicles

** The Enforcement Speed is Considered to be the Legal Speed Limit Plus [illegible]

TABLE IV

TRUCK WEIGHT-SPEED DATA
COMPARISON OF DATA FROM STUDIES IN VARIOUS YEARS

	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
No. of Single-Unit Trucks	493	578	791	1242	1482	1239	905	762	952	1028	837	481
Ave. Speed of Single-Unit Trucks*	42.4	42.2	42.4	43.0	43.4	43.9	45.8	45.9	47.0	46.3	46.5	45.5
Ave. Weight of Single-Unit Trucks*	8,800	9,400	8,700	8,600	8,700	8,400	8,000	8,900	8,300	9,400	9,900	9,230
No. of Semi-Trailers	627	581	879	1,402	1,354	1,507	1,064	1,120	1,033	1,161	1,130	604
Ave. Speed of Semi-Trailers	42.7	43.2	42.7	43.5	44.1	43.1	43.6	43.5	44.4	42.5	46.1	48.6
Ave. Weight of Semi-Trailers	31,900	32,500	36,700	36,700	35,900	35,800	37,400	38,400	37,900	37,100	39,500	40,300

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75 1959	STATION 81 AUG. 28, 1959		SUMMARY		
O. OF RUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	WEIGHT (KIPS)
12	41.0	3	50.2	40	0 — 4
28	49.4	6	50.2	93	4 — 5
	9		133		TOT. TRUCKS
0	4,330		4,380		AVG. WT. (LBS)
	46.6		47.2		AVG. SPEED
)	66.7		31.6		% EMPTY
22	44.7	7	48.8	119	5 — 8
18	44.1	8	47.1	114	8 — 12
8	40.0	3	46.8	51	12 — 16
3			46.1	28	16 — 20
1	43.3	4	46.6	14	20 — 24
1	50.0	1	45.6	4	24 — 28
1	49.0	1	48.9	6	28 — 32
1			45.1	6	32 — 36
1	43.0	1	43.2	4	36 — 40
			46.5	2	40 — 44
	25		348		TOT. TRUCKS
30	13,540		11,100		AVG. WT. (LBS)
8	44.1		44.9		AVG. SPEED
0	36.0		30.8		% EMPTY

TABLE I SINGLE UNIT TRUCK SPEEDS IN MILES PER HOUR

WEIGHT (KIPS)	STATION 45-B AUG. 6, 1959		STATION 5 AUG. 12, 1959		STATION 4 AUG. 13, 1959		STATION 2 AUG. 14, 1959		STATION 14 AUG. 19, 1959		STATION 42 AUG. 24, 1959		STATION 58-B AUG. 25, 1959		STATION 75 AUG. 26, 1959		STATION 81 AUG. 28, 1959		SUMMARY		WEIGHT (KIPS)
	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	
0 — 4	57.0	3	51.6	3	53.0	5	51.0	1	52.0	1	48.0	1	46.5	11	52.5	12	41.0	3	50.2	40	0 — 4
4 — 5	51.5	9	51.0	4	50.2	8	57.5	2	49.0	14	52.8	5	50.6	17	49.1	28	49.4	6	50.2	93	4 — 5
TOT. TRUCKS	12		7		13		3		15		6		28		40		9		133		TOT. TRUCKS
AVG. WT. (LBS)	4,250		4,170		4,300		4,130		4,450		4,270		4,680		4,300		4,330		4,380		AVG. WT. (LBS)
AVG. SPEED	52.9		51.3		51.3		55.3		49.2		52.0		49.0		50.1		46.6		47.2		AVG. SPEED
% EMPTY	90.0		83.5		69.3		33.0		60.0		83.4		67.9		55.0		66.7		31.6		% EMPTY
5 — 8	50.4	17	50.5	6	49.4	16	53.0	6	49.4	13	52.0	14	45.1	18	47.6	22	44.7	7	48.8	119	5 — 8
8 — 12	50.1	14	48.4	11	47.0	10	47.0	6	51.6	10	51.0	17	44.5	20	43.4	18	44.1	8	47.1	114	8 — 12
12 — 16	44.0	6	46.2	7	47.6	6	48.5	2	48.4	5	51.6	7	48.2	7	45.0	8	40.0	3	46.8	51	12 — 16
16 — 20	45.6	3	49.0	4	46.0	6	48.0	1	45.0	1	57.5	2	46.2	8	40.0	3			46.1	28	16 — 20
20 — 24	45.0	1			46.6	3			47.0	2	56.0	2	48.0	1	41.0	1	43.3	4	46.6	14	20 — 24
24 — 28			47.0	1	46.0	1									24.0	1	50.0	1	45.6	4	24 — 28
28 — 32			55.0	2					44.0	2					46.0	1	49.0	1	48.9	6	28 — 32
32 — 36					42.0	1	49.0	2	35.0	1	52.0	1			44.0	1			45.1	6	32 — 36
36 — 40									45.5	2					42.0	1	43.0	1	43.2	4	36 — 40
40 — 44					46.5	2													46.5	2	40 — 44
TOT. TRUCKS	41		31		45		17		36		43		54		56		25		348		TOT. TRUCKS
AVG. WT. (LBS)	10,020		13,300		13,190		13,010		12,550		10,300		8,890		10,880		13,540		11,100		AVG. WT. (LBS)
AVG. SPEED	48.9		48.9		47.4		49.6		48.7		52.0		45.2		44.8		44.1		44.9		AVG. SPEED
% EMPTY	25.7		29.6		26.7		41.2		44.4		41.9		42.6		25.0		36.0		30.8		% EMPTY

ER HOUR

	75	STATION 81		SUMMARY		
	959	AUG. 28, 1959				
WEIGHT	O. OF EMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	WEIGHT (KIPS)
0—8	2			48.5	2	0 — 8
8—1	1			52.0	1	8 —12
12—1	1	48.0	1	42.4	11	12 —16
16—2	7	55.0	1	48.0	44	16 —20
20—2	3	48.0	1	49.0	85	20 —24
24—2	6	52.0	1	50.2	92	24 —28
28—3	1			49.1	47	28 — 32
32—3	4	46.0	1	49.0	43	32 — 36
36—4	1	50.0	1	48.4	29	36 — 40
40—4	1			49.5	34	40 — 44
44—4	3			48.9	27	44 — 48
48—5				48.2	37	48 — 52
52—5	4	52.0	1	47.6	46	52 — 56
56—6	4	47.0	1	47.6	32	56 — 60
60—6	2	43.0	1	46.5	23	60 — 64
64—6		55.0	2	46.1	19	64 —68
68—7	1			47.7	11	68 — 72
72—		43.0	1	42.8	6	72 — 76
76—8	1			49.0	11	76 — 80
80—				48.0	3	80 — 84
100—1				30.0	1	100— 104
TOT. TR		12		604		TOT. TRUCKS
AVG. WT. 0		44,000		40,300		AVG. WT. (LBS)
AVG. SPEE		49.5		48.6		AVG. SPEED(MPH)
% EMI		25.0		32.8		% EMPTY

TABLE II SEMI-TRAILERS (MULTIPLE UNITS) SPEEDS IN MILES PER HOUR

WEIGHT (KIPS)	STATION 45-8 AUG. 6, 1959		STATION 5 AUG. 12, 1959		STATION 4 AUG. 13, 1959		STATION 2 AUG. 14, 1959		STATION 14 AUG. 19, 1959		STATION 42 AUG. 24, 1959		STATION 58-8 AUG. 25, 1959		STATION 75 AUG. 26, 1959		STATION 81 AUG. 28, 1959		SUMMARY		WEIGHT (KIPS)
	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	
0-8															48.5	2			48.5	2	0 — 8
8-12															52.0	1			52.0	1	8 — 12
12-16	44.6	3	46.5	2	56.0	1			57.0	1	50.0	1	42.0	1	42.0	1	48.0	1	42.4	11	12 — 16
16-20	45.9	8	45.2	5	49.4	4	52.0	1	52.8	6	49.7	11	39.0	1	45.5	7	55.0	1	48.0	44	16 — 20
20-24	50.5	14	46.5	12	47.9	8	47.0	7	50.1	15	53.1	8	47.8	17	49.0	3	48.0	1	49.0	85	20 — 24
24-28	46.1	7	52.2	8	48.1	12	53.2	12	52.8	17	54.4	15	46.0	14	47.1	6	52.0	1	50.2	92	24 — 28
28-32	54.0	2	47.6	5	44.8	12	42.0	1	54.0	9	52.0	9	48.1	8	45.0	1			49.1	47	28 — 32
32-36	46.2	5	48.0	9	46.5	4	52.6	5	49.6	6	56.0	5	46.5	4	51.0	4	46.0	1	49.0	43	32 — 36
36-40	48.5	5	49.5	6	45.3	3	51.0	1	46.4	5	50.5	2	49.0	5	46.0	1	50.0	1	48.4	29	36 — 40
40-44	46.6	5	51.4	5	43.8	6	52.0	4	53.2	9	49.3	3	49.0	1	46.0	1			49.5	34	40 — 44
44-48	55.4	3	42.6	3	48.0	2	45.5	2	51.0	10	54.0	2	44.5	2	45.0	3			48.9	27	44 — 48
48-52	52.1	5	47.6	5	44.8	5	50.4	6	49.1	8	49.3	5	39.3	3					48.2	37	48 — 52
52-56	50.5	4	46.0	8	45.3	6	52.6	3	49.7	10	50.2	5	42.8	5	45.5	4	52.0	1	47.6	46	52 — 56
56-60			43.8	5	44.0	1	50.8	6	49.4	10	51.0	3	43.5	2	41.5	4	47.0	1	47.6	32	56 — 60
60-64			42.8	6	42.0	1	47.7	4	49.7	4	49.3	3	46.5	2	48.5	2	43.0	1	46.5	23	60 — 64
64-68	52.0	1	45.6	3	37.3	3	57.0	1	50.2	4	48.0	1	39.5	4			55.0	2	46.1	19	64 — 68
68-72	52.0	1	40.0	2			56.4	3	50.0	1	46.6	3			34.0	1			47.7	11	68 — 72
72-76	40.0	1			38.0	2			50.0	1			48.0	1			43.0	1	42.8	6	72 — 76
76-80			49.0	1	48.5	2	62.0	1	51.3	3	47.5	2	40.0	1	42.0	1			49.0	11	76 — 80
80-84									48.0	3									48.0	3	80 — 84
100-104													30.0	1					30.0	1	100 — 104
TOT. TRUCKS	64		85		72		57		122		78		72		42		12		604		TOT. TRUCKS
AVG. WT. (LBS)	33,400		48,800		37,600		43,700		41,400		36,200		37,500		35,600		44,000		40,300		AVG. WT. (LBS)
AVG. SPEED (MPH)	48.8		47.2		45.9		50.2		50.9		51.6		45.7		46.1		49.5		48.6		AVG. SPEED (MPH)
% EMPTY	18.8		34.1		18.1		40.4		32.8		53.9		31.9		31.0		25.0		32.8		% EMPTY

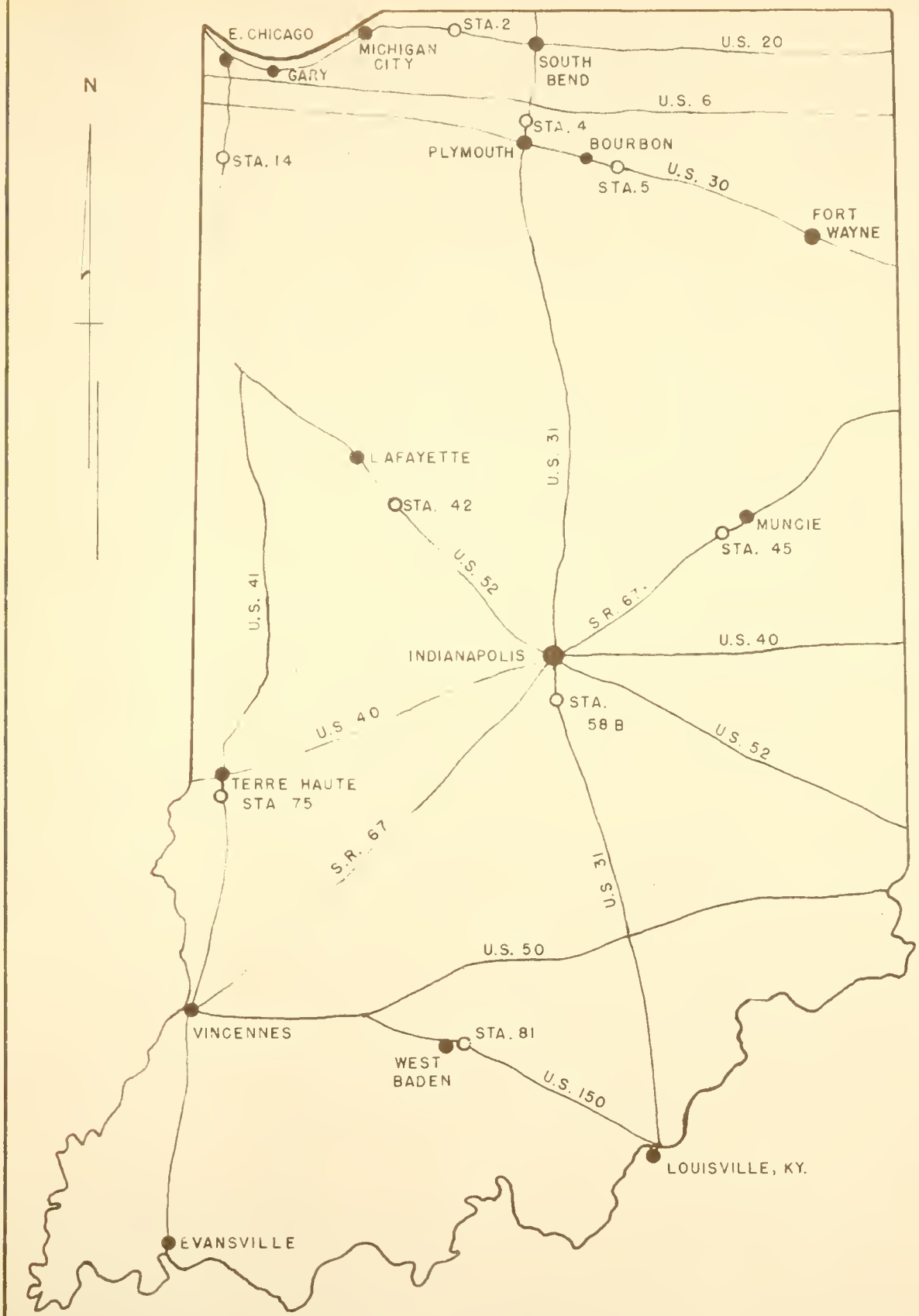
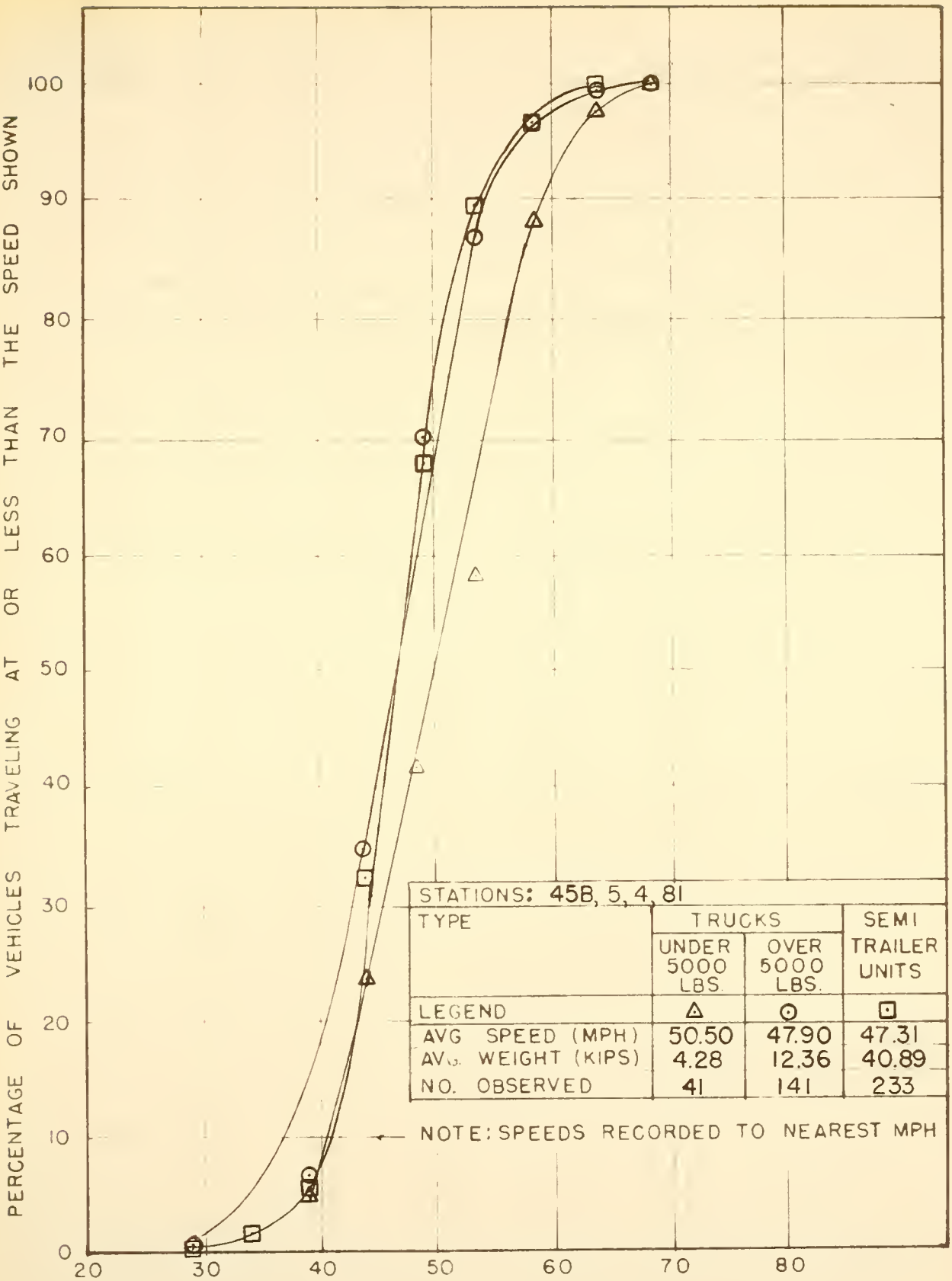
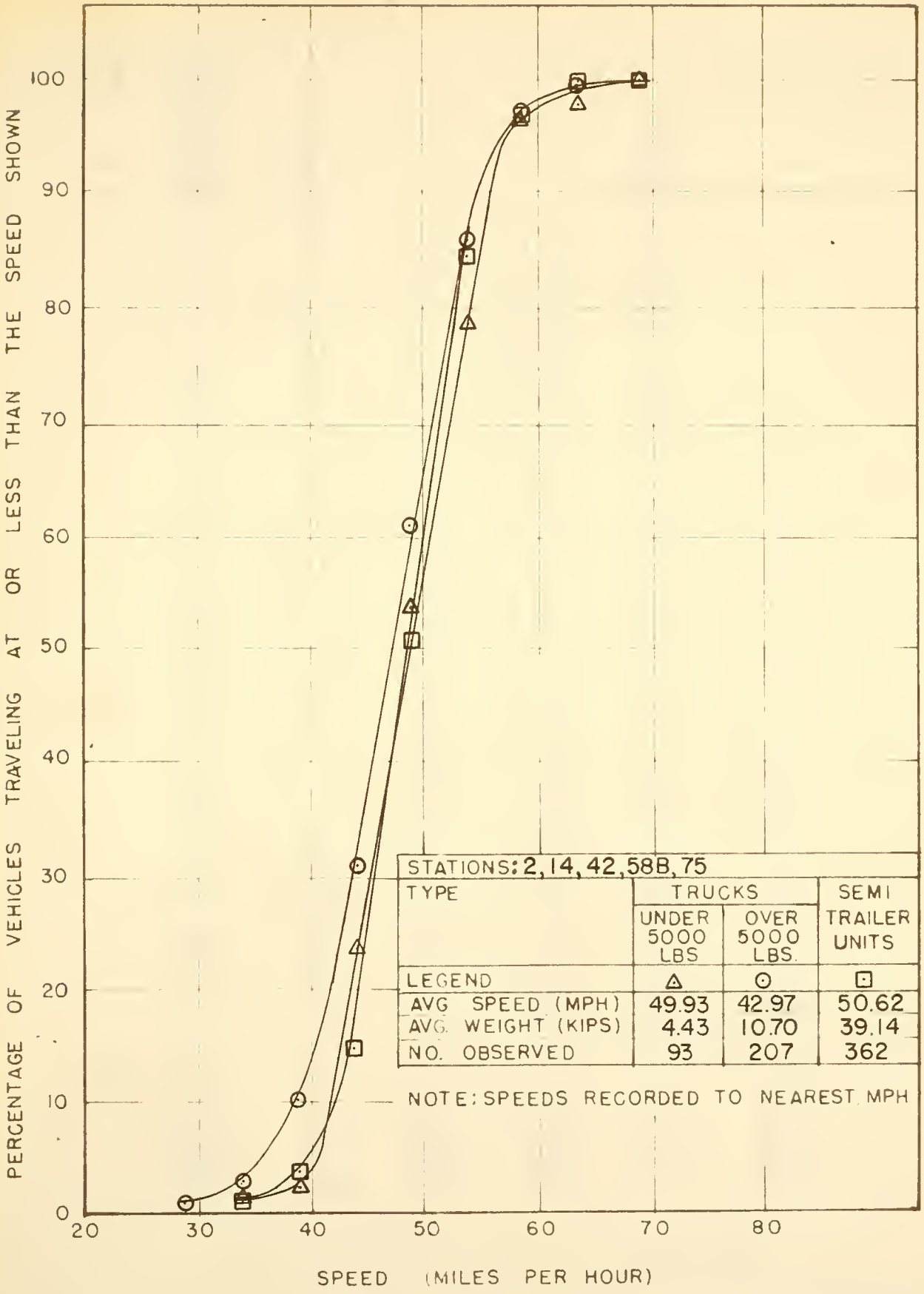


FIG. 1 LOCATIONS OF TRUCK WEIGHT - SPEED STATIONS



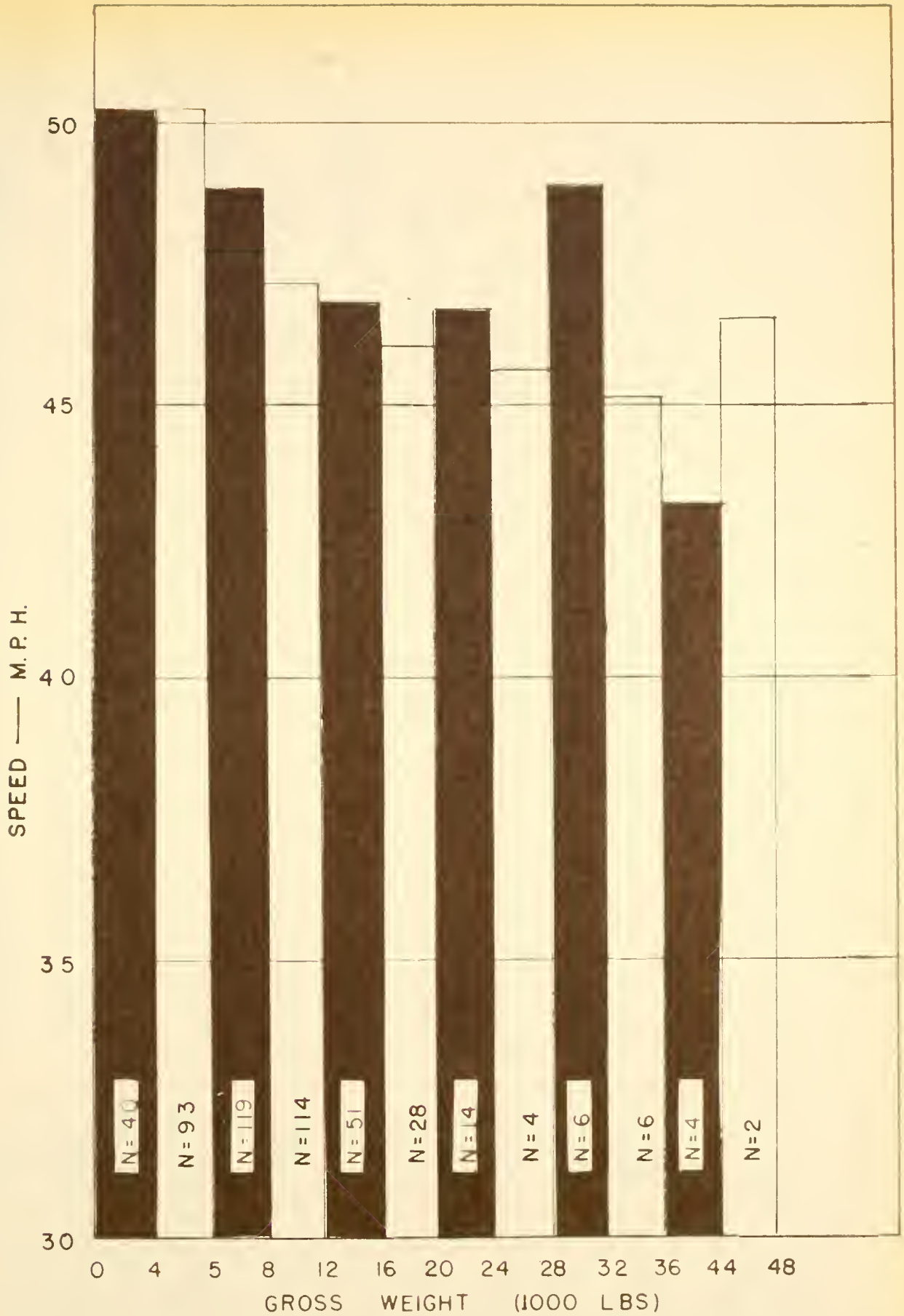
SPEED ACCUMULATION CURVES FOR TWO-LANE HIGHWAYS

FIG. 3



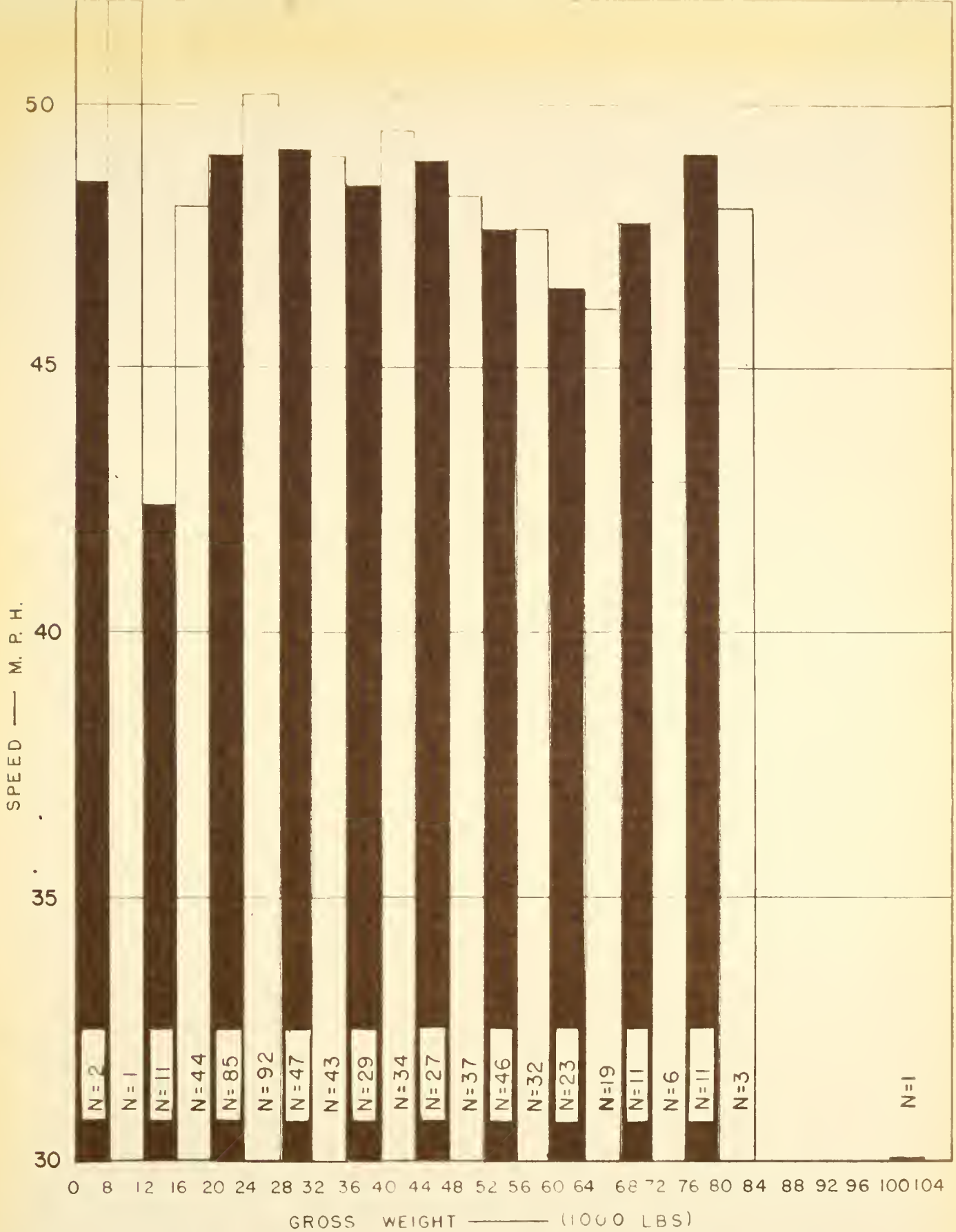
SPEED ACCUMULATION CURVES FOR FOUR-LANE HIGHWAYS

FIG. 4



AVERAGE SPEED VS. GROSS WEIGHT FOR SINGLE UNITS

FIG. 5



AVERAGE SPEED VS. GROSS WEIGHT FOR SEMI — TRAILERS

FIG 6